RUFORUM Working Document Series (ISSN 1607-9345) No. 14 (1): 609-614.
Available from http://repository.ruforum.org

Research Application Summary

Allocative efficiency in potato production in lowland areas of Uganda

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Abstract

Potato (*Solanum tuberasum*) is an important crop in Uganda. Although it was traditionally grown in highland areas, its cultivation has now spread to lowlands. However there is limited information on the performance of potato within the low altitudes and how resources are allocated to attain maximum profit. A study involving 276 potato farmers was carried out to; i) characterize potato farmers in the lowland districts, and ii) estimate the level of allocative efficiency among potato farmers. Data were analysed by way of t-test and linear ordinary least squares regression. Results showed a significant difference in household size, age, area allocated to potato, extension contact access, output and capital among potato farmers that planted potato in both seasons and those that planted potato in one season. Potato farmers who planted in both seasons also had significantly more experience in potato production compared to those that planted in one season. Farmers who planted potatoes in both seasons had more land allocated to it. There was inefficient in-put allocation with the allocative efficiency index being either greater than or less than one. This study has shown that inputs used by potato farmers were allocated inefficiently and farmers who planted in two seasons were found to be more experience, allocated more land to potato, produced more output and used more capital. It is recommended for potato farmers to increase on capital used, reduce on labour and land allocated to potato.

Key words: East Africa, Economic growth, *Solanum tuberasum*

Résumé

La pomme de terre (*Solanum tuberasum*) est une culture importante en Ouganda. Bien qu'elle ait été traditionnellement cultivée dans les zones montagneuses, sa culture s'est maintenant étendue aux plaines. Cependant, il y a peu d'informations sur la performance de la pomme de terre dans les plaines et l'allocation des ressources pour atteindre le maximum de profit. Une étude portant sur 276 producteurs de pommes de terre a été effectuée pour; i) caractériser les producteurs de pommes de terre dans les districts de plaine, et ii) estimer le niveau de l'allocation efficace par les producteurs de pommes de terre. Les données ont été analysées par un t-test et une régression ordinaire linéaire des moindres carrées. Les résultats ont montré une différence significative dans la taille du ménage, l'âge, la zone

allouée à la pomme de terre, l'accès à la vulgarisation, le capital et la production entre les producteurs de pommes de terre qui ont planté la pomme de terre au cours des deux saisons et ceux qui ont planté la pomme de terre pendant une seule saison. Les producteurs de pommes de terre qui ont planté dans les deux saisons ont également plus d'expérience dans la production de pommes de terre que ceux qui ont planté pendant une saison. Les producteurs qui ont planté des pommes de terre dans les deux saisons avaient alloué plus de terres à la culture. Une mauvaise allocation d'intrants a été constaté avec l'indice d'efficacité de l'allocation étant soit supérieur ou inférieur à un. Cette étude a montré que les intrants utilisés par les producteurs de pommes de terre ont été mal alloués, que les producteurs qui ont planté la pomme de terre sur les deux saisons ont plus d'expérience, allouent plus de terres pour la pomme de terre, produisent plus et utilisent plus de capital. Il est recommandé pour les producteurs de pommes de terre d'augmenter le capital utilisé, réduire le travail et la terre allouée à la pomme de terre.

Mots clés: Afrique de l'Est, croissance économique, *Solanum tuberasum*

Background

Potato (*Solanum tuberasum*) contributed to economic growth and urbanization in the old world between 1700 and 1900 after its introduction (Nunn & Qian, 2011). Its currently ranked the third most important tuber crop grown by small scale farmers both as a cash and food crop worldwide (Muthoni *et al*., 2013). Potato productivity is increasingly becoming essential to the farmers as they increased its production (Leeuwis *et al*., 2009). In Africa, 65% of potato is produced and traded mainly in Egypt, South Africa, Algeria, Morocco and likely to increase with the growing demand (Ferris *et al*., 2001; Thiele, 2010). The high demand of potato among consumers indicates an increase in need for production of the crop in East African countries (Ferris *et al*., 2001; Leeuwis *et al*., 2009). In Uganda potato production has expanded from high altitude areas to low land areas (1200-1600 masl). This has been attributed to farmers migrating from high to low altitude zones as well as the adoption of suitable varieties (Ferris *et al*., 2001). This study determined the allocative efficiency for potato production in low altitude areas.

Literature summary

Many studies have analyzed farmers' social demographics such age, household size, gender, marital status, education and off farm income (Onubuogu *et al*., 2014). However, these studies merely posit the means and t-test with less in depth analysis of the effect of these factors on resource use. Allocation of resources is efficiently attained when marginal value cost is equal to marginal factor cost (Debertin, 2012). Some studies (Usman and Bakari, 2013; Kadiri *et al*., 2014) have shown resource allocation to be fairly attained. Resource allocation among the low altitude Uganda potato farmers is however barely known.

Study description

A multi stage sampling strategy involved purposive sampling of districts which were the leading potato producers within the lowland areas. This followed purposive selection of sub

counties followed by random selection of parishes, villages and potato household farmers. A sample of 121 potato farmers was attained in Isingiro since it was the leading potato producer among the three districts with the highest population. A representative sample of 94 potato farmers was selected in Rakai due to low population in relation to Isingiro. Only 61potato farmers were selected in Lyatonde since it was less involved in farming of potato than the other districts making a total of 276 representative sample size used in the study. Data were collected for two potato producing seasons. The study employed cross sectional design using questionnaire administered through direct interview. Characterization of farmers was analyzed using descriptive statistics like means and t-test.

Allocative efficiency was analyzed using linear Cob Douglas production function $\ln y = \beta_o + \sum_{i=1}^{n} \beta_i \ln x_i + e$. The coefficient attained was multiplied with the average physical product to get marginal physical product MPP= $\frac{y_i}{x_i} * \beta_i$. The allocative efficiency was then obtained from $p_y MPP_i = MVP_i = w_i$. Where p_y price of output, w_i was unit price of capital (shillings), labour (hours) and area allocated to potato (hectares). The marginal value output was equated to w_i a vector of input prices

Research application

The results in Table 1 showed that age, area allocated to potato, household size, extension contact, output, capital and experiences of the farmer were significant among potato farmers that planted potato in both seasons and those who planted potato in one season. However, education was found to be insignificant among both farmer categories. There was a significant difference between potato farmers who planted in both seasons and those who planted one season in terms of their age, experience, output produced, capital used, household size and area allocated to potato. Potato farmers who planted in one season were younger compared to those who planted in both seasons. Potato farmers that planted potato in two seasons were found to allocate more land to potato than those that planted in one season. Potato farmers that planted both seasons attained more output compared to those that planted one season however they used more capital than potato farmers that planted potato in one season.

The results of allocative efficiency for capital, labour and area allocated to potato ranged from zero to infinity. Average physical production, marginal physical product and marginal variable product were found to be positive which conformed to economic theory. Average physical product of capital was less than marginal physical product in season 1 and equal in season 2. This showed capital was in stage two of production with increasing marginal productivity. Average physical product for labour was equal to marginal physical product for all seasons. This revealed that labour was in the second stage of production. Marginal

physical product for area allocated to potato was noted to be greater than the average physical product which showed diminishing marginal productivity. This also confirmed that potato farmers aimed at maximises profit and there was room for expansion in input use.

The results attained revealed that inputs are not allocated efficiently in both season 1 and season 2. The results in (Table 2 and Table 3) were contrary to the findings by Ogundari and Ojo (2006); Ugwumba (2010). However the same findings were similar to the findings of Oniah *et al*. (2008) and Mallam *et al*. (2014). The studies found all resources to be allocatively inefficient. This shows that there is need for reduction in area allocated to potato and labour in both seasons to increase allocative efficiency and the need to increase on capital usage in order to improve its allocative efficiency.

Table 1. Descriptive analysis for continuous variables by potato growers and non potato growers (planted potato in one of the seasons)

Variable	Planted potato in both seasons n= 272 mean	Planted potato in one season n=34 mean	T value
Household size	5.975	6.471	0.993*
Age (years)	41.074	37.353	(1.734)*
Education(years)	5.512	5.618	0.16
Area allocated to all crop	3.608	2.07	(1.570)*
Area allocated to potato	0.632	0.265	(2.470)**
Area allocated to potato<3	1.855	1.941	1.020 *
Area allocated to potato <2> 1	0.855	1.618	4.666 ***
Area allocated to potato >1	0.632	0.265	(2.470)**
Experience of the farmer(years)	8.607	2.706	(4.309)***
Extension visit access	0.248	0.147	(1.297)*
Labour (hrs)	10.14	8.34	-0.66
Output (kg)	4226.394	931.824	(3.956)***
Capital (shs)	16970.99	6710.76	(1.911)*

Table 2. Allocative efficiency for season 1

Variable	Average physical product	Marginal physical product	Marginal value product	Input price	Allocative efficiency
Capital (shs)	2399.499	2447.655	916509.56	7816.896	117.247
Labour (hours)	52.788	52.813	32253.62	32253.62	0.613
Area for potato (ha)	3914.665	2283.137	854907.007	4691030.000	0.182

Table 3. Allocative efficiency for season 2

Variable	Average physical product	Marginal physical product	Marginal value product	Input price	Allocative efficiency
Capital (shs)	3189.876	405811.384	405811.384	7890.153	51.433
Labour (hours)	65.684	7399.073	7399.073	27371.01	0.270
Area to Potato (ha)	4361.045	834.587573	292332.658	4691030.000	0.062

Acknowledgment

This study was greatly supported by the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) in funding this research. This paper is a contribution to the 2016 Fifth African Higher Education Week and RUFORUM Biennial Conference.

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